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ABSTRACT

Madisonville Community College (MCC) is in Madisonville, Kentucky, a small town with a strong coal industry presence. Mine closings and layoffs in the 1980s prompted the region to reorient itself toward light industry and manufacturing, but the recession of the early 1990s and globalization led to closings of several of the largest employers. In 1995, MCC developed a Lean Manufacturing Simulation and Implementation Program. Lean manufacturing refers to a philosophy of efficiency used by Toyota that shortens the time between customer order and factory shipment by eliminating waste. The Tennessee Valley Authority (TVA) awarded a grant of $12,000 to MCC to help get the program started. The MCC program is based on a program at the Center for Robotics and Manufacturing Systems (CRMS) at the University of Kentucky (UK). Toyota Manufacturing, Inc. was the catalyst and gave UK the seed money. The Lean Manufacturing program at MCC consists of a simulation of lean manufacturing practices and training courses in lean manufacturing principles and concepts. The expansion of the region's manufacturing base highlights the success of the MCC program. The article suggests that if MCC can develop an introductory program for non-manufacturers, MCC can help more local firms to be more profitable and serve a greater portion of the business community in the service area. (NB)

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Madisonville Community College: Training Small Manufacturers to be Competitive in the Global Economy

Madisonville is a small town in western Kentucky. It's in a rolling area not as conducive to large grain farming as the rest of western Kentucky but it is the only part of western Kentucky with a strong coal industry presence—mainly strip mining. The economy of Madisonville and the surrounding region has long depended upon the coal industry until mine closings and layoffs in the 1980s prompted the region to reorient itself toward light industry and manufacturing. But the recession of the early 1990s coupled with the globalization of the economy led to the closings of several of the largest employers. As a result, the regional economy lags behind most of the rest of the state.

The nation responded to these difficult times by focusing its attention on the modernization and competitiveness of its locally owned small and mid-sized companies. In the early 1990s, the University of Kentucky's Center for Robotics and Manufacturing Systems, working with the community colleges, became Kentucky's delivery system for modernization. One of the tools of competitiveness was a set of management and production techniques developed for the auto industry that became known as lean manufacturing.

In 1995, Madisonville Community College (MCC) developed a Lean Manufacturing Simulation and Implementation Program and its Business and Industry (B & I) Department became a licensed provider of the Lean Manufacturing Simulation, the training program developed by the University of Kentucky (UK) in partnership with Toyota. That year UK invited community colleges across the state to be trained and licensed because the demand was too much for UK alone. Recognizing its potential value to local manufacturers, MCC accepted the invitation. The B & I Department was already offering various programs in manufacturing systems, quality improvement, and team building, and administrators believed that lean manufacturing would complement their existing programs. By partnering with the Tennessee Valley Authority and other community colleges, MCC was able to successfully develop the Lean Manufacturing Program and deliver the simulation to firms inside and outside of their service area.

Community Background

Madisonville Community College is located in Madisonville, Kentucky. The college was established in 1968 and serves five counties: Hopkins, Crittenden, McLean, Muhlenberg, and Webster. Madisonville is a community of about 20,000, and the five counties served have a population of around 112,000, a figure that has been stable for last twenty years. The educational attainment within the region is relatively low, with high school and college graduation rates in the region below the state average, which in turn is well below the national average.

After struggling for most of the 1990s, the regional economy has begun to rebound and experience growth in the last few years. General Electric, the largest employer in Madisonville, recently increased its work force and expanded its facility, and there have been seven announcements of new manufacturing facilities in the last twenty months. However, the region still has higher than average levels of unemployment and poverty, and its median household income is below the state average. Currently, the key industries in this region are automotive parts, plastics, appliances, wood products, industrial machinery, health care, and coal mining.

What is Lean Manufacturing?

Lean manufacturing is the technical term for what is more popularly called the "Toyota Production System." It is a philosophy of efficiency that shortens the time between customer order and factory ship-

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ment by eliminating waste when it is properly implemented. Lean manufacturing provides a system for identifying and eliminating waste. But the emphasis is on cutting within the job, not the person, and then redistributing personnel to be more efficient. The benefits of lean manufacturing include strong commitment to innovations by employees, continuous improvement, and increased efficiency with respect to production cost and quality control.

The core concepts of lean manufacturing include kaizen (continuous improvement techniques), just-in-time delivery, "pull" systems, building to order, quality at the source, value stream mapping, and teamwork. Lean manufacturing, however, is not just a collection of concepts and practices that firms can "copy and paste" into their businesses. It is a system of concepts and practices that reinforce each other, and it requires the understanding of the entire system to benefit the firm. The concepts and practices of lean manufacturing create a work environment where all employees can understand the existing practices, make suggestions for improvement, and implement these changes.

Program History

The Tennessee Valley Authority (TVA), through its economic development activities, awarded a grant of $12,000 to MCC to help get the program started. TVA's interest was in serving new and existing industry in western Kentucky, and MCC used the funds to purchase the equipment and training it needed for the Simulation.

The Lean Manufacturing program at MCC is based on the program at the Center for Robotics and Manufacturing Systems (CRMS) at the University of Kentucky that was established in 1993. Toyota Motor Manufacturing, U.S.A., Inc. was the catalyst and gave UK the seed money. After opening its Camry plant in Georgetown, Toyota wanted to have a model factory to use in training other U.S. manufacturers. Toyota chose UK as its partner because of the educational and research capacities of the CRMS and the close proximity to its plant in Georgetown. Toyota also provided training and technical support to CRMS staff to develop the Lean Manufacturing program.

After CRMS staff members had gone through the training programs and established several classes on lean manufacturing principles, they realized that they needed a pilot program to introduce the concepts to businesses and to be their flagship program. To do that, CRMS developed a one- day simulation of lean manufacturing based. By 1995 the demand for UK's Lean Manufacturing Simulation was more than it could handle, so they invited community colleges to be trained and licensed providers of the Simulation. Only Lexington Community College (LCC) and Madisonville Community College accepted the invitation.

The B & I department at MCC became the licensed provider for several reasons. First, it was an excellent opportunity to provide a valuable service to local. But B & I staff also recognized that the Lean Manufacturing Simulation was very lucrative financially, which is important since this department of the college is expected to be self-sustaining. It is now a self-supporting program that significantly helps the B & I Department to fulfill its mission. Finally, they knew the Simulation was a good program and they had a strong working relationship with CRMS.

At first MCC received most of its clients through referrals by UK. But by 1998 MCC had firmly established itself as a provider of the Lean Manufacturing Simulation in Kentucky, and the program has continued to grow ever since. In the last 16 months, MCC has conducted 32 simulations in just western Kentucky. Plus, MCC has partnered with the Kentucky Community and Technical College System, so that community colleges across the state can offer lean manufacturing training to local companies by hiring MCC to conduct the simulation. Because so many companies have asked for MCC's help in implementing the lean manufacturing system, MCC has developed follow-up programs to the simulation. Currently, MCC offers five training courses to businesses that train them to implement lean manufacturing.

The Lean Manufacturing Simulation and Implementation Program

The Lean Manufacturing program at MCC consists of a simulation of lean manufacturing practices and training courses in lean manufacturing principles and concepts. The Simulation is a hands-on approach that familiarizes participants with the concepts and benefits of lean manufacturing by simulating a factory floor, progressing from a traditional layout to one based on lean manufacturing principles. This program was recently been recognized as the number one manufacturing assistance program in the state of Kentucky.

The annual operating budget for lean manufacturing programs is about $150,000, and the revenue comes from training fees charged to the companies

for the program. State matching grants from the Bluegrass State Skills Corporation also help companies pay for the training through. Staff members from the B & I Department will assist companies in completing and submit their applications for funding from the Bluegrass State Skills Corporation.

Program Components

The Lean Manufacturing Simulation and Implementation program consists of an intense one-day introduction to lean manufacturing and a set of training courses for companies interested in implementing the lean manufacturing system. The Simulation is designed to familiarize employees at levels with the lean manufacturing philosophy. In the implementation, MCC provides courses on the principles and concepts of lean manufacturing to train companies to implement it themselves.

Simulation

The Simulation alternates between a classroom and plant floor setting. In the classroom, participants are exposed to many lean manufacturing concepts, including: kaizen (continuous improvement), visual control, quality at the source, standardized work, pull system, continuous flow, build to order, work leveling, teamwork, and just-in-time. While in the simulated plant floor, participants manufacture a functioning product (circuit board) in four intensive rounds. They see, feel, and measure the effects of the lean manufacturing principles because the simulated manufacturing process progresses from a traditional to a lean manufacturing system during the four rounds. After the first round, a few lean manufacturing concepts are incorporated each round to show their effects, and by the last round the plant has been transformed from a traditional manufacturing system to a lean manufacturing system.

The equipment used in the Simulation is very portable and fits into a few large, plastic cases so that they can conduct the Simulation on site. The MCC staff suggests that employees from all departments and training levels participate in the simulation since the lean manufacturing philosophy needs to be pervasive throughout the organization to have a positive effect on operations. Because the Simulation is interactive and participants actually see the benefits, employees are much more likely to buy into the implementation of the lean manufacturing system.

A team of five is required to lead the Simulation. The lead instructor presents the program, teaches the material on the concepts and principles, and leads the discussions of what just happened on the plant floor in the classroom. MCC has seven full-time staff members who are available to facilitate the Simulation, and MCC can field three teams with part-time staff and consultants.

Implementation

Since most companies ask for help with the implementing lean manufacturing after the Simulation, MCC developed implementation programs, but using a different approach than consultants—training the companies to implement lean manufacturing themselves, not telling them what to do. MCC believes this approach is much more effective because the manufacturing firms have a better understanding of lean manufacturing and how it applies to their business with this method. The core of the Implementation program is five training courses in lean manufacturing principles and concepts, which follows MCC's philosophy of empowering the companies to do it themselves. Each of the classes is twelve hours of classroom instruction and a variable number of hours on the plant floor. Finally, MCC offers classes at the college that relate to implementation, even though not solely designed for that purpose.

Training Courses

Introduction to Lean Manufacturing Concepts teaches production improvement concepts of lean manufacturing covered in this class include: visual control, continuous flow, kaizen, pull inventory systems, just-in-time principles, standardized work, value stream mapping, quality at the source, and work balancing.

Introduction to Kaizen is aimed at production employees and first-line supervisor(s)/team leaders, introduces the concept of continuous improvement with emphasis on "small" improvements that can be easily implemented without large capital expenditure. By completion employees will have implemented their own kaizens and will have detailed plans for implementing others.

Value Stream Mapping includes the actions, both value and non-value adding, currently required to bring a product through the main flows essential to every product. The mapping is a pencil and paper tool that helps understand the flow of material and information as a product makes its way through the value stream.

Visual Factory is the process of getting the entire factory on the same standardized system, so it can be managed more easily and efficiently.

Lean Manufacturing Implementation Strategy uses process mapping and value streaming to define actual plant operations and includes such topics as standardized work, take times, cycle times, 5S, flow, and visual control. Students create a detailed implementation plan that is tailored specifically to their operation.

General Manufacturing Assistance Training Courses

MCC offers several other training courses that are designed to improve the skills of the manufacturing employees of the region and can be beneficial to the implementation of lean manufacturing. These include Computer Aided Design (CADD), Programmable Logic Controllers (PLC), and Computer Numerical Control (CNC). Any of the courses can be offered at the plant or on MCC's campus. Beginning or Advanced instruction levels are available for each, and the course length for each varies greatly depending on the level of sophistication taught.

Two other prominent services offered by the B & I Department are the Jumpstart Entrepreneurial Training Program and training courses in ISO-9000 and QS-9000. The Jumpstart Entrepreneurial Training Program is open to current business owners and potential entrepreneurs, and it concentrates on opportunity recognition, feasibility and business plan preparations, and operations/management techniques of owning and operating a business. For training in ISO-9000 and QS-9000, MCC faculty has developed training modules for all levels of employees. Custom designed training materials have been developed and delivered to suppliers of the automotive industry.

Key Partners

The strength and sustainability of the Lean Manufacturing program have been sustained by partnerships with the TVA and the Kentucky Community and Technical College System (KCTCS). MCC gained the capacity to deliver the program to with help from TVA and MCC and TVA are currently discussing how TVA can support future endeavors of the Lean Manufacturing Simulation and Implementation program. With MCC's partnership with KCTCS, community colleges across the state are able to offer lean manufacturing training to firms in their service area by employing MCC to deliver the training. The community colleges broker the deals between companies interested in receiving training in their service area and MCC, and MCC and the other community college involved receive part of the training fee.

Outcomes and Challenges

The Lean Manufacturing Simulation and Implementation program at MCC has been quite successful. Over a sixteen-month period MCC conducted the Simulation for over 30 companies in western Kentucky. Since the program's inception several thousand people have been trained in lean manufacturing, which translates into a workforce trained to compete in the global economy. The Lean Manufacturing program at MCC has garnered recognition as the number one manufacturing assistance program in the Kentucky, and MCC has become the state carrier of the Lean Manufacturing Simulation by conducting simulations all over the state.

The expansion of the region's manufacturing base highlights the success of the MCC Lean Manufacturing program. Because of the decline in Madisonville's manufacturing base in the early 1990's, locally only seven manufacturing firms have gone through the Simulation. However, there have been seven new announcements in the last twenty months promising 1,600 jobs, and two companies have signed up for the Simulation. Local economic development officials, TVA Economic Development staff, and staff members of the B & I Department at MCC all agree that a labor force trained in lean manufacturing principles and access to lean manufacturing training services have made the Madisonville area much more attractive to companies who are considering setting up shop in the region.

Developing lean manufacturing training programs for non-manufacturing companies, providing services for higher levels of lean manufacturing understanding, maintaining the necessary capacity to properly serve their clients, and staying abreast of new developments in the lean manufacturing and other manufacturing systems are the challenges facing MCC's Lean Manufacturing program. The basic doctrines of lean manufacturing are efficiency and flexibility, which are applicable to any business interested in improving employee efficiency and overall business effectiveness. If MCC can develop an introductory program for non-manufacturers, MCC can help more local firms to be more profitable and serve a greater portion of the business community in their service area. However, creating an effective program will be a great challenge since there is no existing program to model and the great demands that are already placed on the current staff.

Providing more sophisticated level of services in lean manufacturing is important, because once MCC has met the introductory needs, companies need

higher levels of understanding so they can continue to build upon the initial improvements. Developing programs for higher levels of understanding is also important to MCC so they can maintain the necessary demand to sustain the program. To provide these services, it is vital that the MCC staff stays up to date on the trends in lean manufacturing and other manufacturing systems and constantly evaluates the effectiveness of the program. Building up the resources of the program, maintaining the capacity of the staff, and expanding the knowledge of the staff are challenges that must be met for MCC to continue providing a quality introduction to lean manufacturing, develop more lean manufacturing training programs, and provide quality training to local manufacturers.

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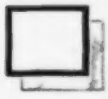

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